

Lower down on the back of the statue there are two *herrerias*—symbolic animals, with albatross-like beaks, which are turned, not ungracefully, towards the bird. Immediately above the waist-belt of the statue—its only dress—there is a circle.

The explanation of these hieroglyphics is at once suggested by the story of the arrival of the chiefs. The two rapas, or steering paddles, were dedicated to the gods, and symbolise the vessels of the two chiefs. They were doubtless carved on the statue to commemorate their safe arrival. The two *herrerias* may represent the chiefs themselves. The circle is the accepted emblem of life.

The same symbolism, though of a more realistic kind, may be recognised in the curious wooden images which are peculiar to Easter Island. They are mostly anatomical; that is, figures in which the ribs, vertebræ, and other bones are distinctly shown, as they would appear in a person suffering from extreme emaciation. They were styled by La Pérouse "*squelettes*." Nearly all of them have strongly marked Semitic features, a tuft on the chin, and highly symbolic carvings on the scalp; e.g., *heronias*, double-headed birds, and a solar deity with rays round the head. The legs of these little images are uniformly short, and the ear-lobes enlarged. There is also very generally, if not always, a circle on the lower part of the back. It can hardly be doubted, in view of the symbolism which pervades almost everything in Easter Island, that these *squelettes* are connected with the story of the voyage from Oparo, and represent the half-starved condition in which it may well be conceived that the crews arrived.

In one of these images, in the Ethnographical Room at the British Museum, the head is perfectly smooth, which appears to intimate that it was shaven. It perhaps represents a priest; for we are informed that Roggewein, the discoverer of Easter Island in 1720, noticed a native with his head shaved, who had large "white balls" in his ears, and appeared very devout: the Dutch judged him to be a priest.

Returning to the tablets, of which casts are in the museum of the Anthropological Institute, it will be sufficient to mention that they are engraved with hieroglyphics on both sides, every part being covered with minute signs, apparently intended as actual representations of various forms of animal and vegetable life; as well as scenes and incidents such as were likely to have been met with among the islands in the Pacific. On the bottom line of what is considered to be the front face of the smaller tablet there is a procession of bird-headed men, who are approaching or standing before a pillar, or stone,* with two discs, or circles, on each side. Immediately before the first figure, which it is presumed is a chief, from his holding a staff in his hand, are two curved lines, the hieroglyphic for a boat or canoe. Behind the chief another bird-headed man is represented as kneeling down, and holding up his hands; he is probably a priest.† A third bird-headed figure follows without a staff. Then, after two small curves high up in the line of hieroglyphics—perhaps a sign for the moon,—there is a character with a bird's head and beak, of a different shape from those of the bird-headed men. It has a crest on its head, and short wings, and is probably intended for a domestic fowl—the only land bird in Easter Island. It appears to be a victim about to be sacrificed. Two more bird-headed men, without staffs, follow in a certain stately order. Then there is a second sign or hieroglyphic for a boat, followed by another chief; and then a third sign for a boat, with a waved or zigzag line before it, which is perhaps intended to signify that the vessel which follows it

was lost or driven away in some other direction by a storm. This last boat is followed by a bird-headed man without a staff.

The signs for the chiefs' vessels, it will be seen, agree in number with the large rapas, or steering paddles, upon the back of the stone statue; and the bird-headed chiefs answer to the two *herrerias*. The diminutive steering paddle, represented apart from the others on the ear of the statue, may symbolise the same casualty that appears to be signified by the waved line, viz., that there was a third boat, which did not reach Easter Island. The small carving of a rapa would thus have been erected merely *in memoriam*. However this may be, taken in conjunction with the tradition, there can be little doubt that the hieroglyphics on the tablet and the carvings on the statue relate to a more important matter than the arrival of the chiefs.

As regards the signs generally, a considerable number have been identified as conventional representations of birds and animals which are not found in Easter Island; weapons, also, and other objects are introduced (e.g., an Eastern bow), which belong to regions far to the west. Some of the identifications that have been suggested may be doubtful; but amongst those that will perhaps meet with general acceptance, by no means the least important are the hieroglyphics of three distinct types of men: (1) Tall, bird-headed men, with short legs, as in the wooden images. (2) Men with large ornaments or projections on each side the head, scarcely exaggerating the practice of enlarging the ear-lobes by inserting in them discs, or plugs of wood and other materials, which prevails in certain islands in the Pacific, as well as amongst the older races in India and Burmah. (3) Dog-faced men, or Negritos, with strangely shaped heads, which, from plates in the "*Cruise of the Curaçoa*," appear to be characteristic of the natives of the Solomon Islands, as well as the more westerly islands of the Fiji group. They squat like the dog-faced men in the tablets, whilst the large-eared men sit in the Eastern manner. The peculiar appearance of the head is explained by the custom of dressing and plastering the hair. Several of these Negritos are represented about the middle of the tablet as celebrating a fish-fête; the men dancing by themselves on one side, and the women in couples on the other. Two of the men with enlarged ear-lobes stand by as spectators.

Enough has perhaps been said to suggest the great importance of an early and systematic exploration, above and below ground, of Easter Island and Oparo, as almost unworked mines, abounding in matter of the greatest ethnological and anthropological interest.

J. PARK HARRISON

ON THE DISTRIBUTION OF THE HEAT DEVELOPED BY COLLISION*

MANY of our colleagues who have become aware of a fact in thermodynamics which it has been in our power recently to observe, think it possessed of so great an interest that I ought immediately to announce it to the Academy. It is as follows:—

During the forging, which has been very successful, of the ingot of platino-iridium for the standard metre, I at first remarked that it sometimes produced, under the action of the hammer, luminous streaks, having an oblique direction upon the lateral faces of the piece, when this, while cooling, was yet at the temperature of a dull red. I showed some of these effects to M. Fizeau, but they were then incomplete, and I have only lately succeeded in obtaining a good observation of the phenomenon, and in defining its character with perfect certainty.

* A paper read by M. Tresca before the Paris Academy of Sciences June 8.

* Compare the legend of the "Emigration of Turi," Pol. Myth. p. 214. "Amongst the chiefs who landed there was one called Porua . . . the second (dog) they cut up raw as an offering for the gods . . . and built a second place, and set up pillars for the spirits."

† See Pol. Myth. p. 136, where a priest is mentioned as accompanying a boat expedition.

It is known that when a bar of metal is lengthened by means of a powerful hammer on an anvil of the same form as the head of the latter, each blow produces, above and below, a symmetrical contraction, the effect of which is to give to the bar the aspect of a series of projections separated by small level spaces.

At the time of the collision, these spaces, which are formed before and behind the impress of the hammer, upon the upper and the lower face of the bar, are connected, at a certain moment, upon the lateral faces, by luminous lines passing from the one to the other, and presenting altogether the appearance of an X written in lines of fire. The phenomenon is only visible for a certain temperature of bar which is being wrought, but then each blow invariably produces its effect, and, in consequence of the confused mingling of the imprints, we see the entanglement of these crossed lines which encroach upon each other. These brilliant bands appear at the same moment as the collision, but they do not disappear with it, and their continuance was sufficiently prolonged to enable us to count six luminous cross-bars visible at one time, although developed by six successive blows of the hammer.

I have been able, moreover, to get this persistence confirmed by several persons in the foundries of M. Farcot, who, with the greatest kindness, placed his services at the disposal of the Metric Commission for the execution of the work.

Although the lines of the cross-bars appeared to us all rectilinear, and although we could not compare them to anything better than two series of straight lines, parallel and intercrossed, we think it will be indispensable to determine their form more exactly by appropriate processes, and to discuss it with the greatest care.

It is well known that hammering develops heat in the bodies hammered; thermodynamics teaches us that these thermal effects ought to be regarded as the result of mechanical work or of *demiforce vive* exerted during the collision, but the precise place in which the calorific development is produced has not yet been noticed.

For ourselves, we do not hesitate to affirm that the zone which becomes luminous is that along which the matter mainly flows, at the moment when the change of form takes place, according to a law which we were enabled to discover in our previous researches in molecular displacements. If this first indication should be confirmed, there would be thus obtained a more exact knowledge of the mode of distortion determined by the forging, and the phenomenon which we describe would evidently form a new scientific connection between thermodynamics and the question with which we ourselves are personally occupied under the title of "Flowing of Solid Bodies."

The phenomenon ought to be the same for all metals, and we have already ventured to hazard some considerations of the particular causes of the brightness which it presented in the case of platinum, and which has not, so far as we know, been yet observed in any other forging.

The exceptional hardness of the platino-iridium, cooled to a dull red heat, requires, for an equal distortion, an amount of work at least equivalent to that of the forging of steel, and in consequence of the relative smallness of the calorific capacity of this alloy, this same work ought to be converted into calorific phenomena, more localised and more intense. Moreover, the material is more homogeneous than iron, and is notable for a kind of remarkable translucency which makes one believe that the eye can follow the shade of red to a certain depth. The effects, whatever they may be, are thus rendered more manifest, more especially as they are not accompanied by any exudation of foreign matter nor by any oxidation of the surface. All these circumstances are eminently favourable to the observation which chance permitted us to make, and which, once confirmed in the case of platinum, may certainly be

renewed with other metals, although possibly in a more restricted manner than in the case of the alloy of MM. Deville and Debray.

We confine ourselves for the present to a summary indication of the principal fact, which appears to us to have a certain importance, and which consists in this appearance of luminous bands which arise from collision, and the position of which enables us to fix the precise place where is developed the heat which represents under another form the work done by motion: this fact is, perhaps, of a nature to open some new path for the researches, so carefully made, of the physicists of our epoch on all that touches on molecular mechanics and on the calorific actions which are connected with them.

The ingot of platinum has already been brought into the form of a bar with a square section of 4.50 m. in length; there will be a chance of continuing the same observations in the new operations of forging to which it will be submitted; the chance of renewing them may perhaps not again be offered.

SUBJECTS FOR PRIZES PROPOSED BY THE HAARLEM SOCIETY OF SCIENCES

THE following subjects for prizes are proposed by the Haarlem Society of Sciences:—

I. Competition of 1875, the limit of which is fixed on Jan. 1, 1875.

1. To give for ten sorts of glass of known chemical composition—(a) The coefficients of dilatation between 0° and (at the most) 100°, having regard to the influence of the tempering and the state of tension; (b) The coefficients of elasticity with exact indication of the temperatures; (c) The indices of refraction for at least ten points distributed over the whole extent of the spectrum, also with precise indication of the temperature.

2. Does the coefficient of dilatation of steel vary with the degree of tempering, and can we establish empirical laws on the subject of the connection between these two elements?

3. Can there be established by experiment a connection between the diffusion of liquids through porous partitions and other phenomena, such as capillarity, &c.?

4. Determine the coefficient of dilatation for at least three liquids of simple composition, according to the process by which the absolute dilatation of mercury has been established.

5. Researches are sought on the origin of sensitive organs, especially of the visual organ, among some of the inferior animals; this origin being considered, as far as possible, in relation to the conditions in which the animal is found, and the external influences to which it is subject.

6. In terrestrial magnetism, what are the periods known with sufficient accuracy, and how far have these periods been proved to be connected with cosmic or telluric phenomena?

7. New experiments and observations are wanted to clear up the following question:—How are albumenoid matters formed and removed in plants?

8. Determine exactly the density, the coefficient of dilatation, the point of fusion, the point of ebullition, the specific heat, the index of refraction, and the specific rotatory power of at least twenty organic combinations, pairs of which are isomeric and whose chemical composition is known.

9. The experiments of M. Regnault on the specific heat of certain terpenes, and those of M. Berthelot on diamylene and triamylene, having shown that the specific heat of polymeric bodies of one combination may be equal to that of the fundamental matter from which they originate, it is desired that these researches be extended to as great a number as possible of other combinations having between them the same relations, for the purpose of deciding if the observed fact may or may not be raised to the rank of a general law.

10. New researches are sought on tetraphenol and its derivatives, for the purpose of deciding on the value of the hypothesis of M. Limpricht concerning the existence of a series of aromatic matters with a nucleus composed of four atoms of carbon.

11. Give a critical sketch of experiments and observations concerning the existence of *Bacteria* in contagious diseases, followed by original researches on the same question investigated in one or more of these maladies.